Azymuth Acoustics UK

Professional Acoustic Services

# Noise Impact Verification Report (planning conditions 15a)
# Ref: Z62503.4

## 70No. New Build Dwellings
## Heatherdale Drive
Cheetham Hill,
Manchester

On behalf of

**Mosscare St Vincents (MSV)**
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**Document Status – Final**

| Ref: Z62503.2 Rev A | [redacted] | Name: | Date: |
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# 1.0 Introduction

Azymuth Acoustics UK (henceforth Azymuth) has been contracted by Mosscare St Vincents (MSV) Housing Group to perform a Noise Impact Verification Report in relation to 70no. new build dwellings located at Heatherdale Drive, Cheetham Hill, Manchester and to discharge planning condition 15a.

## 1.2 Planning condition 15a

*Notwithstanding the Azymuth Acoustics noise impact assessment dated 21st May 2024 reference Z62503.2, prior to the commencement of each phase of development a scheme for acoustically insulating the proposed residential accommodation against noise from surrounding roads and streets within that phase of development shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises.*



*Figure 1 – Site plan of proposed development*

This (revised) noise impact assessment is intended to provide information relating to potential noise levels affecting the site, to assist with delivering the project in accordance with the planning application and to discharge planning condition 15a for the residential development. In particular, the report sets out the following details:

- The results of a baseline noise survey undertaken in the vicinity of Heatherdale Drive
- The appropriate assessment criteria and guidance relating to noise in the environment as associated with this kind of development
- Recommendations to meet the targets as set out by the assessment criteria

# 2.0 Baseline Noise Survey

## 2.1 Measurement Procedures

The instrumentation used for the NIA consisted of a SvanTek 971 type 1 precision sound level meter. The equipment was calibrated before and after measurements. The sound level meter measured A-weighted (fast response) noise levels as well as octave bands noise levels for all measurement record.

Daytime noise level measurements were undertaken between 11:15hrs - 13:56hrs on Wednesday 7th February and between 09:57hrs - 11:43hrs on 13th February 2024. The night-time measurements were undertaken between 23:00hrs and 00:43hrs on Monday 19th / Tuesday 20th February 2024.

The noise measurements were undertaken using the sound level meter at the position(s) shown in Figure 2 below:

- Position 1: Waterloo Road (~2m from roadside)
- Position 2: Tamerton Drive (~0.5m from roadside)
- Position 3: Dinnington Drive (~2m from roadside)
- Position 4: Heatherdale Drive (~3.5m from roadside)

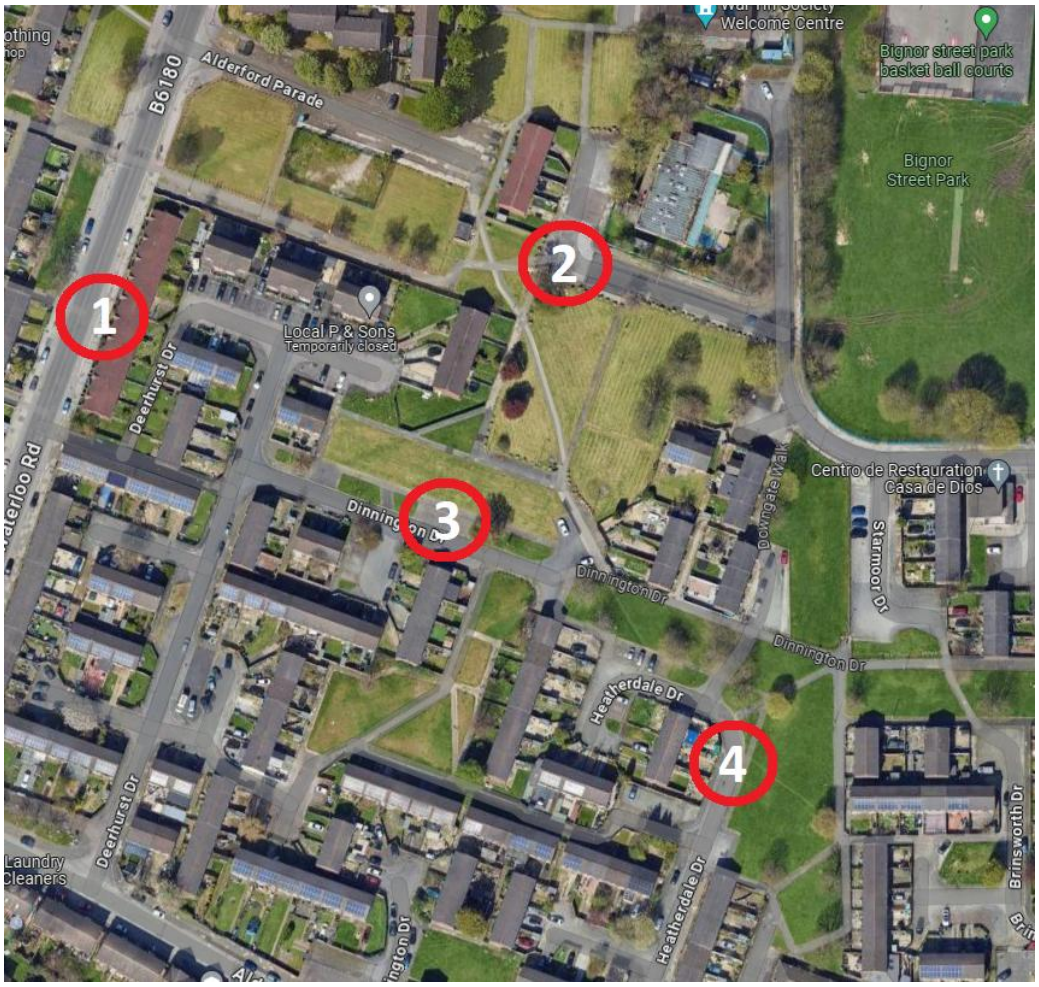



*Figure 2 – Noise measurement position(s)*

## 2.2 Summary of Measurements

### 2.2.1 Noise Survey

The following table summarises the results of the noise measurements undertaken at the proposed site in terms of the average daytime and night-time noise levels.

| Location | Period | $L_{AFmax}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A50}$ | $L_{A90}$ |
|---|---|---|---|---|---|---|
| 1) Waterloo Road | Day | 86.1 | 70.1 | 72.3 | 64.8 | 57.7 |
| 1) Waterloo Road | Night | 85.5 | 68.7 | 72.8 | 58.1 | 45.1 |
| 2) Tamerton Drive | Day | 64.1 | 51.0 | 52.6 | 49.6 | 47.9 |
| 2) Tamerton Drive | Night | 54.3 | 42.1 | 44.1 | 41.0 | 39.2 |
| 3) Dinnington Drive | Day | 62.1 | 48.6 | 50.0 | 47.7 | 46.0 |
| 3) Dinnington Drive | Night | 49.3 | 39.7 | 40.5 | 38.9 | 37.6 |
| 4) Heatherdale Drive | Day | 60.6 | 49.3 | 50.3 | 48.3 | 47.0 |
| 4) Heatherdale Drive | Night | 47.2 | 39.8 | 40.7 | 39.5 | 38.5 |

*Table 1 – Summary of noise measurements*

Full results of the noise levels recorded during the course of the survey are included in Appendix B of this report.

### 2.2.2 Assessment of Night-time $L_{Amax}$ Data

Azymuth has carried out an assessment of the available night-time $L_{Amax}$ noise level data for the noisiest measurement position, Position 1 (referenced to ~2m from the roadside). The highest measured $L_{Amax}$ values were in the range of 82-85dB and the duration of the night-time survey at this position was exactly 30 minutes hence it is estimated that the 10$^{th}$ highest $L_{Amax}$ value over the entire 8hr night-time period is likely to be around 85-87dB.

## 2.3 Description of Noise Climate

The main source of noise affecting the site originates from traffic along Waterloo Road which sees a modest traffic flow day-to-day.

During the first daytime measurement procedure there was noise originating from nearby construction hence additional daytime measurements were undertaken. The second set of measurements were taken with no construction noise and as such can be deemed most representative of the typical ambient noise levels. These measurements have been used to inform the overall noise impact assessment.

The weather during the measurement procedure was dry with wind speeds ranging from 5 to 10mph.

# 3.0 Assessment Criteria

In order to assess the extent of any measures required in order to comply with suitable conditions relating to potential noise sources, Azymuth Acoustics UK has reviewed various guidance documents and standards, these include:

- ProPG: Professional Practice Guidance on Planning and Noise (New residential development)
- National Planning Policy Framework (NPPF 2023)
- British Standard 8233:2014
- World Health Organisation Guidelines on Community Noise
- British Standard 4142:2014+A1:2019
- IOA Guide to Noise Requirements of Approved Document O 2022
- Acoustics Ventilation and Overheating Residential Design Guide 2020

## 3.1 ProPG: Planning and Noise - May 2017

This Professional Practice Guidance on Planning and Noise (ProPG) has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. The National Planning Policy Framework (NPPF) encourages improved standards of design. The CIEH, IOA and the ANC have worked together to produce this guidance which encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.

The Professional Practice Guidance on Planning and Noise States 'The recommended approach is intended to give the developer, noise practitioner, and decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of acoustic issues that would be faced'. It is important that acoustic design is reviewed at an early stage of the development process.

## 3.2 National Planning Policy Framework (NPPF) 2023

The NPPF provides guidance to local authorities taking into account noise in making planning decisions. Paragraph 185 of the National Planning Policy Framework (NPPF) states that planning policies and decisions should aim to:

- Mitigate and reduce to a minimum to a minimum potential adverse impacts resulting from new development – and avoid noise giving rise to significant adverse impacts on health and quality of life,
- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;

The NPPF states that the planning system should distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework. In addition, NPPF states that the planning system should 'prevent both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability'.

## 3.3 British Standard 8233: 2014

BS 8233 provides a code of practice for the sound insulation of a variety of building types affected by general environmental noise. It provides recommendations for control of noise in and around buildings and suggests appropriate internal ambient noise level criteria / limits for a variety of different situations including residential properties.

The following table summarises the noise limits suggested by BS 8233 applying to residential properties:

| Activity | Room | Good Design Range $L_{Aeq,T}$ dB | |
|---|---|---|---|
| | | 07:00-23:00hrs | 23:00-07:00hrs |
| Resting | Living Room | 35 | - |
| Dining | Dining Room / Area | 40 | - |
| Sleeping (daytime resting) | Bedroom (at night) | 35 | 30 |

*Table 2 – Noise Limits for Residential Properties Suggested in BS 8233*

BS 8233 also states that traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$, which would be acceptable in noisier environments.

## 3.4 World Health Organisation Environmental Noise Guidelines (ENG) 2018

The main purpose of the 2018 WHO guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from the following sources: transportation (road traffic, railway and aircraft), wind turbines and leisure activities.

The guidelines set out to define recommended exposure levels for environmental noise in order to protect population health. Exposure limits are average levels defined over a period of one year, measured outdoors in free field at the most exposed façade. It should be noted that the document does not provide guideline limit values for multiple noise sources in combination.

The 2018 guidelines supersede the Community Noise Guidelines from 1999. Nevertheless, the document recommends that all CNG indoor guideline values and any values not covered by the current guidelines should remain valid. As such, the following guidance would remain appropriate:

For protection against sleep disturbance inside dwellings, night-time noise levels should not exceed 30dB $L_{Aeq}$ for continuous noise and 45dB $L_{Amax}$ for typical single sound events (which are exceeded 15 times or more per night – see ProPG Appendix A.12 for more details).

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise (interpreted as noise from all sources combined) should not exceed 55dB $L_{Aeq}$ on balconies, terraces and in outdoor living areas.

It should be noted that exposure levels defined in ENG and CNG are for guidance purposes as relates potential adverse health impacts and should not be interpreted as absolute limits or regulations.

## 3.5 British Standard 4142:2014+A1:2019

"Methods for assessing and rating industrial sound" describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

- Typically, the greater the difference between background sound and industrial/commercial noise, the greater the magnitude of the impact.

- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

BS 4142 notes that: "Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

## 3.6 IOA Guide to Noise Requirements of Approved Document O 2022

Approved Document O 'Overheating' was released in December 2021 and came into effect in England on 15th June 2022. It introduces requirements for various types of residential premises to limit unwanted solar gains in summer and provide an adequate means to remove heat from the indoor environment (Requirement O1 (1)). Requirement O1(2)(a) of the regulation requires that account must be taken of the safety of an occupant, and their reasonable enjoyment of the residence. There is also a requirement (O2(b)) that mechanical cooling may only be used where sufficient heat cannot be removed from the indoor environment without it.

The guide aims to set out a method to demonstrate compliance to the Building Control Body of the noise constraints in Approved Document O. This guide provides clarity for practitioners and regulators so that assessments can be carried out consistently, and the outcome is repeatable and reliable.

## 3.7 Acoustics Ventilation and Overheating Residential Design Guide 2020

The Acoustics, Ventilation and Overheating Guide (AVO) is intended to be used by acoustic practitioners as well as all those involved in the planning, development, design and commissioning of new dwellings.

It recommends an approach to acoustic assessments for new residential developments that take due regard of the interdependence of provisions for acoustics, ventilation and overheating. Application of the AVO Guide is intended to demonstrate good acoustic design as described in the ProPG, when considering internal noise level guidelines.

## 3.8 Recommended Noise Assessment Criteria

Based on the guidance above it is recommended that the following criteria would be reasonable with the aim of minimising the impact of the environmental noise on the proposed new residential accommodation:

- Daytime noise levels not to exceed 35dB $L_{Aeq,\ 16hr}$ in living rooms / bedrooms
- Daytime noise levels not to exceed 40dB $L_{Aeq,\ 16hr}$ in dining room / kitchen
- Night-time noise levels in bedrooms not to exceed 30dB $L_{Aeq,\ 8hr}$
- Night-time single sound events in bedrooms not to exceed 45dB $L_{Amax}$ more than 15 times a night
- Noise levels in external amenity spaces to not exceed 50dB $L_{Aeq,T}$, with an upper guideline of 55dB $L_{Aeq,T}$ in noisier environments

Table 4, Note 5 of BS 8233:2014 states: 'If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.'

# 4.0 Assessment of Results

## 4.1 Assessment of Noise Risk

The following noise and overheating risk assessment highlights the level of risk of an adverse effect based on the guidance from the ProPG and AVO guidance documents.

Calculated noise levels have been derived from the SoundPLAN noise model and represent the worst-case (free-field) noise level on the worst affected façade at the receiver position.

| Location | Time of Day | Measured/Calculated Noise Levels (dBA) | ProPG Risk of Adverse Effect | AVO Guide Risk (overheating) Category |
|---|---|---|---|---|
| 1) Waterloo Road (at 8.5m from road) | Daytime $L_{Aeq, 16hr}$ | 67 Calculated | Medium | High |
| | Night-time $L_{Aeq, 8hr}$ | 64 Calculated | High | High |
| 2) Tamerton Drive | Daytime $L_{Aeq, 16hr}$ | 51 Measured | Negligible/Low | Negligible |
| | Night-time $L_{Aeq, 8hr}$ | 42 Measured | Negligible/Low | Negligible |
| 3) Dinnington Drive | Daytime $L_{Aeq, 16hr}$ | 49 Measured | Negligible | Negligible |
| | Night-time $L_{Aeq, 8hr}$ | 39 Measured | Negligible | Negligible |
| 4) Heatherdale Drive | Daytime $L_{Aeq, 16hr}$ | 49 Measured | Negligible | Negligible |
| | Night-time $L_{Aeq, 8hr}$ | 39 Measured | Negligible | Negligible |

*Table 3 – Noise risk assessment for Heatherdale Drive (free-field)*

As shown above, the façades facing directly onto Waterloo Road would represent the most significant overheating risk in terms of potential adverse impact indicating that enhanced ventilation, that would normally be offered by opening windows, will be required. The assessment indicates that relying on opening windows would result in significant noise intrusion, thus disrupting normal sleep. These are north-west facing elevations therefore the overheating condition shall occur fairly rarely. As such, Azymuth have provided ventilation recommendations in Section 5.2.

It should be noted that ProPG does not account for daytime $L_{Amax}$ instances that may arise from vehicles passing by. These instances may cause annoyance during the day to the potential residents. As such, the recommended mitigation has been developed in order to minimise noise complaints to the premises.

## 4.2 SoundPLAN Model

Azymuth has undertaken acoustic modelling with the SoundPLAN noise modelling software to predict and visualise the impact of noise on the proposed development site.

### 4.2.1 Grid Noise Map (GNM)

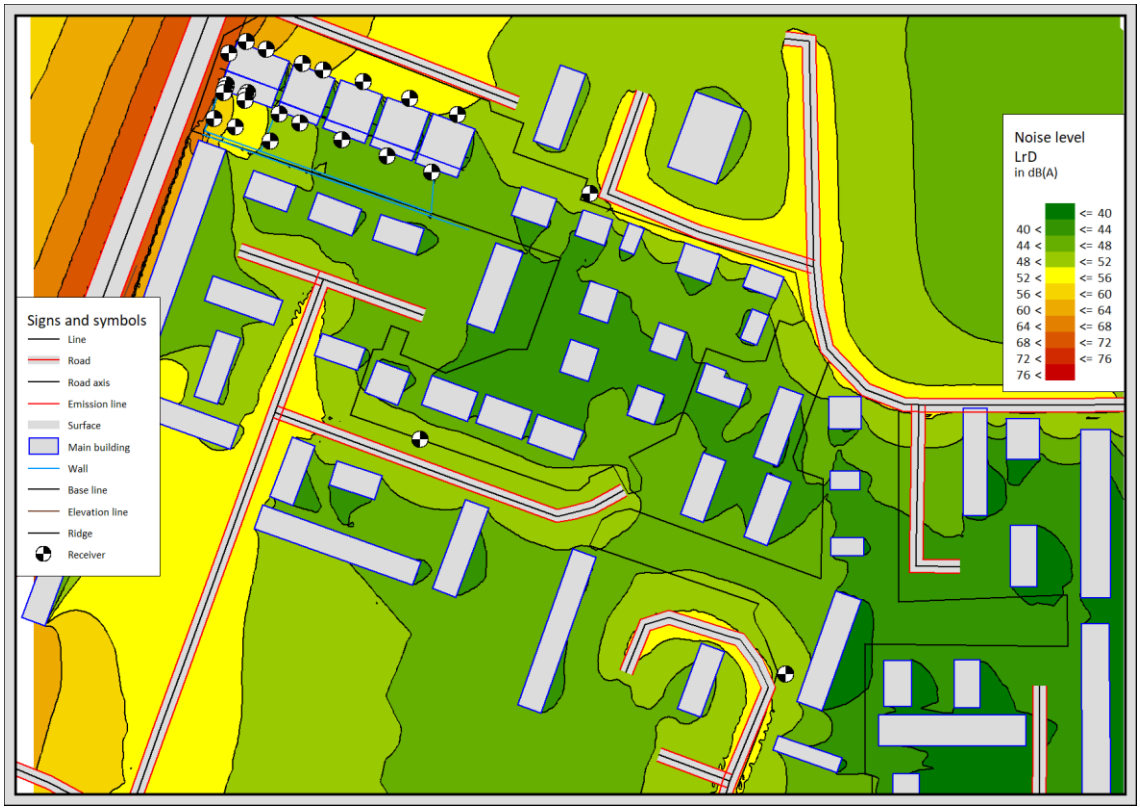



*Figure 3 – Daytime GNM of Heatherdale Drive*

### 4.2.2 Façade Noise Maps (FNM)

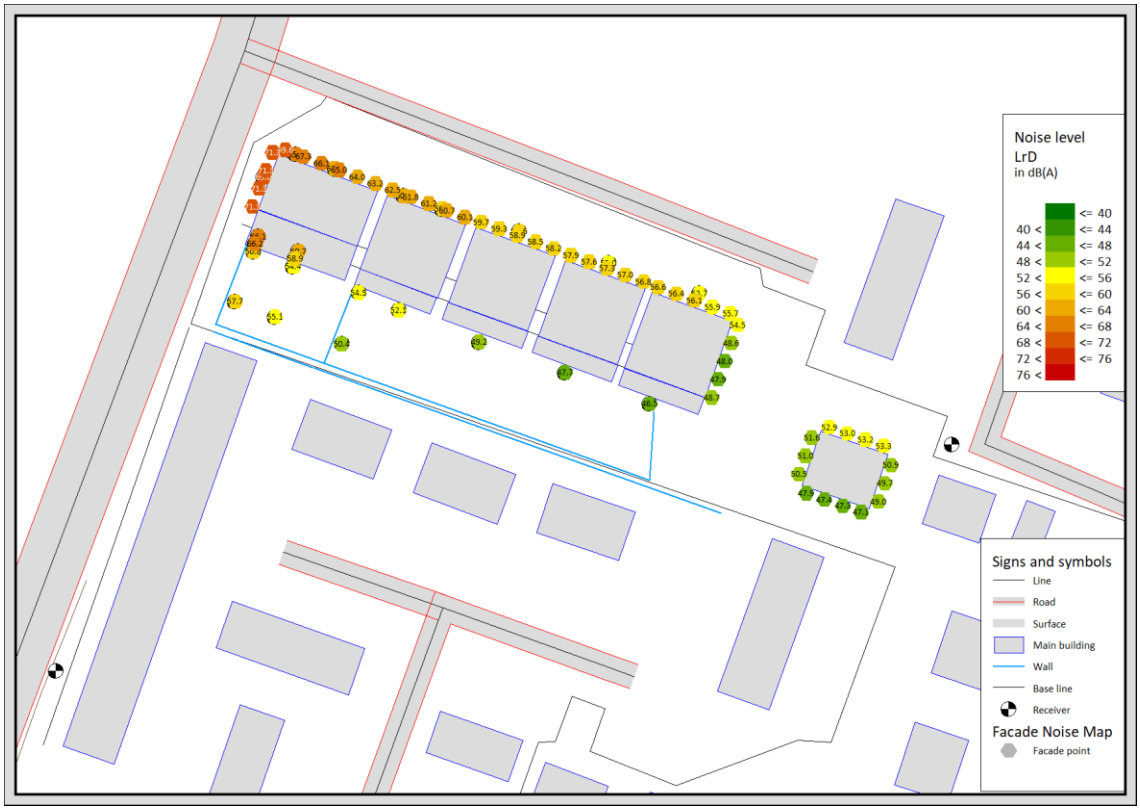



*Figure 4 – Daytime FNM of Plots 1-22 (worst affected)*

## 4.3 Assessment of Noise in External Amenity Spaces

The following noise levels have been derived from the SoundPLAN model and are the likely range of noise levels to be expected in all external amenity spaces.

| Location | Garden Noise Level Range $L_{Aeq,T}$ |
|---|---|
| Alderford Parade / Waterloo Road (Plots 1-5) | 57-62dB (without screening)<br>48-56dB (with 2m acoustic fence) |
| Alderford Parade / Waterloo Road (Plots 6-22) | 47-53dB (with proposed boundary treatment) |
| Tamerton Drive (Plots 22-34) | 44-47dB (with proposed boundary treatment) |
| Dinnington Drive (Plots 40-53) | 48-50dB (with proposed boundary treatment) |
| Heatherdale Drive (Plots 55-70) | 46-48dB (with proposed boundary treatment) |

*Table 4 – Calculated garden noise levels (no mitigation applied)*

Noise levels in the garden of Plot 1 are likely to exceed the guideline target of 55dB $L_{Aeq,T}$ due to the proximity of Waterloo Road. Extra mitigation is required at the boundary of Waterloo Road and Azymuth would recommend installing a 2m high noise barrier to the garden perimeter to shield the external space from traffic noise.

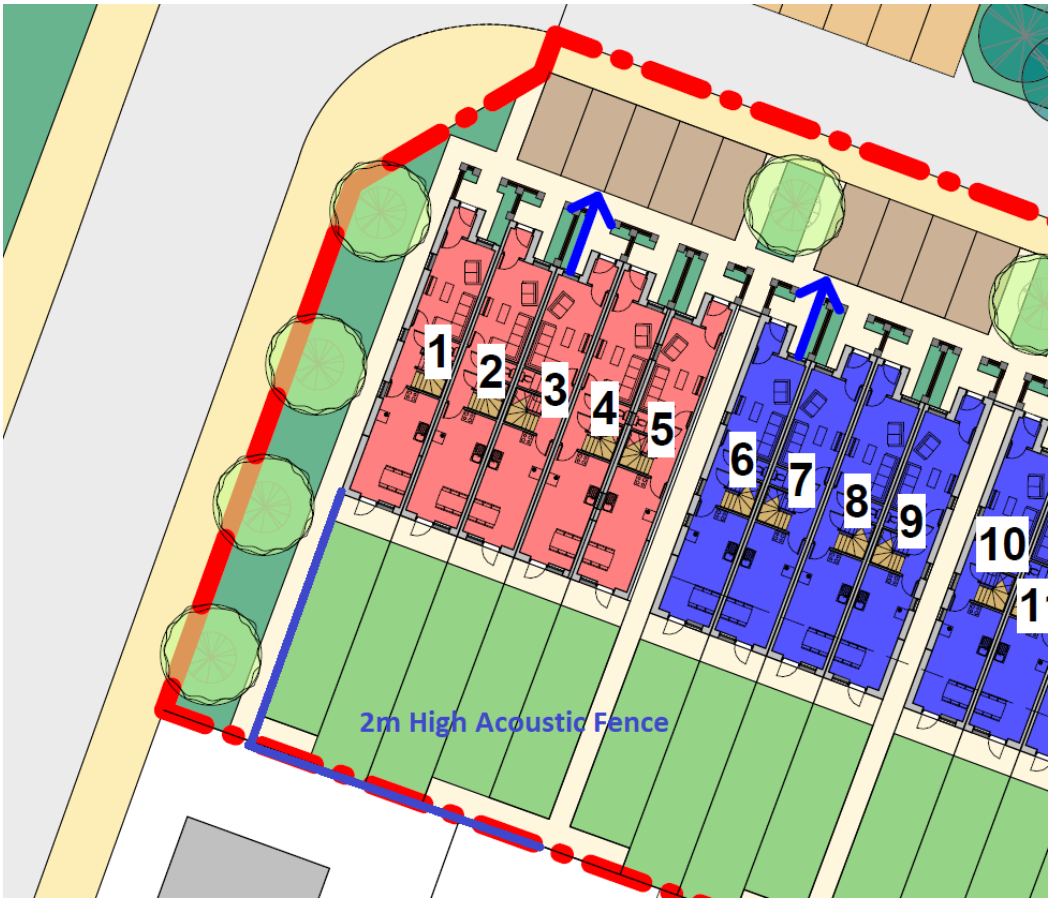



*Figure 5 – Recommended location of noise barrier*

Azymuth have modelled this noise barrier in the SoundPLAN noise model. The inclusion of this noise barrier shall result in external levels in the gardens of Plots 1-22 ranging from 48-56dB $L_{Aeq,T}$ and thus would generally be deemed acceptable.

### 4.4 Assessment of Noise at Velux Windows

Azymuth has calculated the noise at the proposed Velux Windows at plots 1-5 (worst affected) the daytime level at the Velux at plot 1 is 66dBA and this compares to the worst case level of 69dBA for the west facing façade of Plot 1.

This Velux window is located in the kitchen ceiling and as such a daytime internal target of 40dBA would be appropriate, thus implying that the sound insulation of the Velux window should ideally achieve Rw 35 dB / Rw+Ctr 32 dBwould be sufficient here.

Azymuth has reviewed the information on the Velux website such as  glazing type 67 and glazing type 62SG which provide an insulation of Rw 38dB and an Rw+Ctr of 33dB or Rw 42dB and a Rw+Ctr of 37dB both of which are acceptable for plots 1-6.

## 5.0 Recommendations for Noise Mitigation

Based on survey data and the predicted noise levels derived from SoundPLAN, Azymuth have produced the following recommendations in order to mitigate the effects of noise within the proposed development. If these recommendations are followed, noise levels within the development will satisfy the criteria as set out in Section 3.8.

Recommended specifications have been colour coded with reference to Figures 6 and 7.

## 5.1 Recommended Glazing Specification

The table below outlines the glazing specifications Azymuth would recommend in order to achieve the specified internal ambient noise level targets.

| Location (Habitable Spaces) | Glazing Specification | Appropriate Glazing Types |
|---|---|---|
| Dwellings with elevations facing directly onto Waterloo Road (RED) | Any building regulations approved min. 40dB $R_W$ and 34dB $R_W+C_{tr}$ | Acoustic glazing e.g 6mm/16mm argon/6.8mm Pilkington **Optiphon™** or Velux glazing type 62SG |
| Other dwellings located on Alderford Parade (ORANGE) | Any building regulations approved min. 35dB $R_W$ and 32dB $R_W+C_{tr}$ | Acoustic glazing e.g 10mm/16mm/6mm good quality double glazed units or Velux glazing type 67 |
| All other dwellings (GREEN) | Any building regulations approved min. 29dB $R_W$ and 25dB $R_W+C_{tr}$ | Any good quality double glazed units |

*Table 5 – Recommended glazing specification for Heatherdale Drive*

## 5.2 Recommended Ventilation Specification

Table 6 outlines the recommended ventilation that should be paired with the glazing specifications to ensure the appropriate sound insulation targets are met. With reference to the AVO and ProPG guidance, Azymuth recommends the following ventilation specification to ensure sufficient air flow to dwellings whilst also achieving internal noise level targets.

| Location (Habitable Spaces) | Ventilation Specification | Appropriate Day/ Night (ADO) Ventilation stategy |
|---|---|---|
| Dwellings with elevations facing directly onto Waterloo Road and Alderford Parade (ORANGE) | Building Regulations Part F Continuously running MEV with compliant appropriate trickle vents rated at min. 38dB $D_{new}$ Or Mechanical vent with heat recovery (MVHR) may be required on plots 1-5 subject to Part O TM59 assessment | Windows can be generally be assuming to be opened for appropriate daytime periods in order to minimise over-heating. Windows assumed closed at night |
| All other dwellings (GREEN) | Building Regulations Part F Continuously running MEV with compliant / appropriate trickle vents rated at min. 32dB $D_{new}$ | Windows can be used for natural ventilation (assumed open) at most times of day or night |

*Table 6 – Recommended ventilation specification for Heatherdale Drive*

## 5.3 Mitigation Specifications

Window Acoustic Specification:




*Figure 6 – Recommended glazing specification*

Ventilation Acoustic Specification:

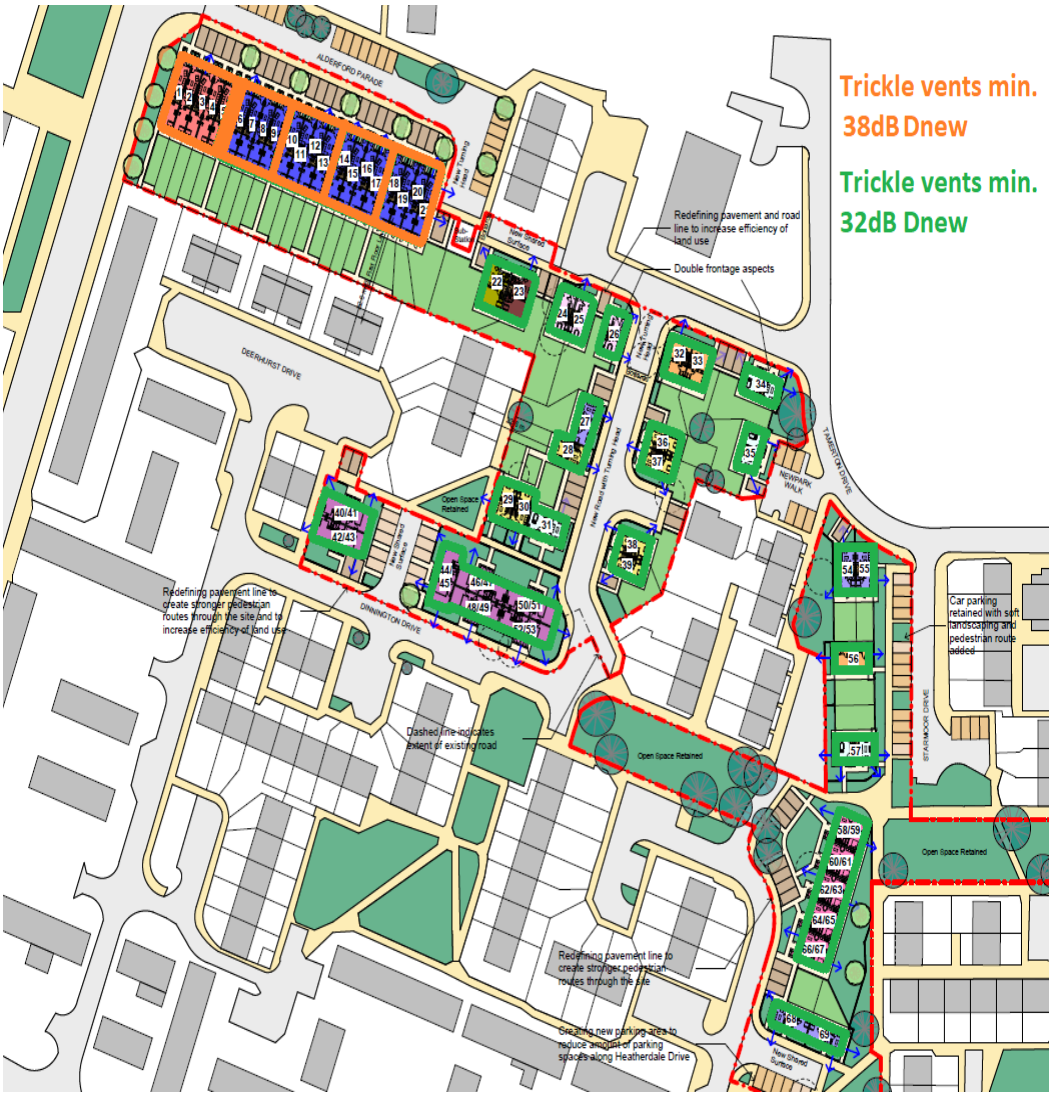



*Figure 7 – Recommended ventilation specification*

## 5.4 Other Elements of Building Envelope

Other elements of the building envelope should have the following sound insulation performance:

- External Walls: minimum sound insulation 58dB $R_W$. This minimum is likely to be significantly exceeded by a normal brickwork façade. Where alternative external wall types (eg composite cladding panels / Metsec build-ups) are proposed on habitable areas it will be appropriate to check whether they comply with the target 58dB $R_W$.
- Roof: minimum sound insulation 45dB $R_W$. This minimum would likely be exceeded with a traditional slate or tile roof with mineral wool loft insulation above plasterboard ceilings or by a suitably insulated concrete roof or composite flat roof. (NB for composite flat roof build-ups a minimum 200mm roof void and 100m mineral wool insulation would be recommended over and above the rigid insulation required to provide the required levels of thermal insulation).

# 6.0 Summary

Azymuth have undertaken a Noise Impact Verifaction Report in relation to a development consisting of 70no. new build dwellings located in the vicinity of Heatherdale Drive, Cheetham Hill, Manchester and to discharge planning condition 15a (full condition found in section 1.1).

Azymuth's Recommendations should be followed so the scheme shall comply with planning condition 15a.

Daytime ambient noise levels surrounding the site were measured to be ~70dB $L_{Aeq,16hr}$ at positions close to Waterloo Road. The noise levels further away from Waterloo Road were measured to be between 48-51dB $L_{Aeq,16hr}$. Night-time (around 2300-2325hrs) noise levels were measured to be approx. 69dB $L_{Aeq,8hr}$ adjacent to Waterloo Road and between 39-42dB $L_{Aeq,8hr}$ at measurement positions further away from Waterloo Road.

Dwellings situated directly adjacent to Waterloo Road possess a medium to high risk of adverse noise effect and overheating. All other areas of the proposed site (located away from Waterloo Road) generally possess a negligible to low risk of adverse noise effect and overheating as per the ProPG and AVO guidance documents.

Azymuth have produced a noise model in SoundPLAN 8.2 to predict and visualise the effect of noise on the development.

Azymuth have produced the following recommendations in order to mitigate the effects of environmental noise on the internal areas of the development.

**Glazing**

- Dwellings with elevations facing directly onto Waterloo Road; min. 40dB $R_W$ and 34dB $R_W+C_{tr}$
- Other dwellings located on Alderford Parade; min. 35dB $R_W$ and 32dB $R_W+C_{tr}$
- All other elevations; min. 29dB $R_W$ and 25dB $R_W+C_{tr}$
- Velux windows to be glazing type 67 or glazing type 62SG both are suitable for all plots. Glazing type 67 38dB $R_W$ and 33dB $R_W+C_{tr}$ Glazing type 62SG 42dB $R_W$ and 37dB $R_W+C_{tr}$

**Ventilation**

- Genrally all dwellings with elevations facing onto Waterloo Road and Alderford Parade; should be satisfactory with continuously running MEV and trickle vents min. 38dB $D_{new}$
- Plots 1-5 facing onto Waterloo Road and Alderford Parade; may require MVHR, subject to a Part O overheating TM59 analysis. MVHR requires no trickle vents.
- All other dwellings; continuously running MEV, trickle vents min. 32dB $D_{new}$

**Other Elements of Building Envelope**

- External walls: min. 58dB $R_W$
- Roof: min. 45dB $R_W$

If the recommendations as mentioned above are to be adhered to then the internal noise levels shall satisfy the assessment criteria as set out in Section 3.8.

# Appendix A – Glossary of Acoustic Terms

**Decibel (dB)**
This is the unit used to measure sound. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro Pascal to 100 Pascal).

**dB (A)**
This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. A-weighting) to compensate for the sensitivity of the human ear to sound of different frequencies. The A-weighting curve is implemented in sound level meters using an electronic filter that approximately corresponds to the frequency response of the ear.

**Octave Band Noise Level**
The human ear is sensitive to sound over a range of frequencies between approximately 20Hz to 20kHz. The ear is also generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum can be divided into frequency bands. The most commonly used frequency bands are octave bands, in which the mid-frequency of each band is twice that of the band below it.

**$L_{Aeq}$**
This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over a given time period.

**Reverberation Time (RT or sometimes $T_{30}$ or $T_{60}$)**
This is the time taken for the reverberant sound energy in an enclosure to decay one millionth of its equilibrium value, i.e. by 60dB, after the source has been switched off. The reverberation time is frequency dependent and it is customary to measure its value in octave or one-third octave bands. Reverberation occurs when sound waves are repeatedly reflected from each surface of the room.

**Sound Reduction Index (SRI)**
Difference measured between the amount of energy flowing towards the wall in the source room and the total amount of energy entering the receiving room (usual range 100 - 3150Hz for one third octave band values). The SRI varies with frequency and is measured in a laboratory in either octave or one-third octave bands.

SRI = L1 - L2 + 10 log (S/A), where:
L1 = Noise level in the source room
L2 = Noise levels in the receiving room
S = Surface area of test specimen
A = Equivalent acoustic absorption area in the receiving room

**Weighted Sound Reduction Index ($R_w$)**
This is a weighted single figure descriptor of the sound insulation performance of a partition measured under laboratory conditions. The procedure used to quantify the $R_w$ is to compare the sound reduction index (SRI) in each of the one-third octave bands from 100Hz to 3150Hz against a set of standard reference curves.

## Appendix B – Noise Survey Data

| Start | Position | Time | $L_{Amax}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A50}$ | $L_{A90}$ |
|---|---|---|---|---|---|---|---|
| Wednesday 7th February 2024 | | | | | | | |
| 11:15:00 | 4 | 00:05:00 | 83.9 | 56.9 | 58.7 | 50.8 | 43.5 |
| 11:20:00 | 4 | 00:05:00 | 85.6 | 69.5 | 73.3 | 57.1 | 49.3 |
| 11:25:00 | 4 | 00:05:00 | 84.6 | 61.1 | 62.6 | 53.3 | 47.9 |
| 11:30:00 | 4 | 00:05:00 | 84.7 | 70 | 73.2 | 67.7 | 59.5 |
| 11:38:00 | 2 | 00:05:00 | 77.2 | 59.6 | 61.1 | 46.3 | 42.7 |
| 11:43:00 | 2 | 00:05:00 | 68.7 | 53 | 52.9 | 46.4 | 42.3 |
| 11:48:00 | 2 | 00:05:00 | 76.5 | 49.7 | 49.3 | 46.1 | 43.6 |
| 11:53:00 | 2 | 00:05:00 | 69.7 | 52.7 | 51.8 | 45.9 | 43.5 |
| 12:00:00 | 1 | 00:05:00 | 78.6 | 66.5 | 70.7 | 61.7 | 53.8 |
| 12:05:00 | 1 | 00:05:00 | 84.1 | 66.1 | 69 | 61.3 | 54.3 |
| 12:10:00 | 1 | 00:05:00 | 89.7 | 66.4 | 69.1 | 63.6 | 58.4 |
| 12:15:00 | 1 | 00:05:00 | 83.4 | 69.8 | 73 | 67.3 | 61.5 |
| 12:31:00 | 3 | 00:05:00 | 77.5 | 62.3 | 65.2 | 60.1 | 55.7 |
| 12:36:00 | 3 | 00:05:00 | 76.7 | 63 | 66.2 | 59.9 | 55.2 |
| 12:41:00 | 3 | 00:05:00 | 79.1 | 62.9 | 65.4 | 60.7 | 55.9 |
| 12:46:00 | 3 | 00:05:00 | 87.9 | 64.5 | 66.1 | 60.8 | 53.9 |
| 12:56:00 | 1 | 00:05:00 | 90.2 | 68.5 | 71.3 | 63.9 | 55 |
| 13:01:00 | 1 | 00:05:00 | 86 | 71.7 | 74.5 | 67.2 | 61.2 |
| 13:06:00 | 1 | 00:05:00 | 90.5 | 74.3 | 78.2 | 68.3 | 59.6 |
| 13:14:00 | 2 | 00:05:00 | 89.2 | 67 | 69.1 | 48.8 | 44.6 |
| 13:19:00 | 2 | 00:05:00 | 83.6 | 59.3 | 56.1 | 47.7 | 44.5 |
| 13:24:00 | 2 | 00:05:00 | 63.7 | 48.8 | 50.7 | 46.6 | 44.5 |
| 13:30:00 | 3 | 00:05:00 | 79.2 | 58.8 | 54.4 | 47.4 | 43.5 |
| 13:35:00 | 3 | 00:05:00 | 83 | 64.7 | 67.1 | 48.6 | 44.1 |
| 13:40:00 | 3 | 00:05:00 | 81.9 | 66.8 | 70.9 | 49.8 | 46 |
| 13:46:00 | 4 | 00:05:00 | 81.2 | 68.1 | 71.5 | 64.2 | 60.7 |
| 13:51:00 | 4 | 00:05:00 | 83.9 | 66.2 | 68.4 | 63.4 | 57.8 |
| 13:56:00 | 4 | 00:05:00 | 81.6 | 64.8 | 66.6 | 62 | 56.1 |
| Tuesday 13th February 2024 | | | | | | | |
| 09:57:00 | 4 | 00:05:00 | 60.4 | 49.8 | 51.3 | 49.3 | 47.8 |
| 10:02:00 | 4 | 00:05:00 | 59.1 | 50.1 | 52 | 49.4 | 47.5 |
| 10:07:00 | 4 | 00:05:00 | 61.3 | 49.1 | 50.7 | 48.2 | 47.1 |
| 10:12:00 | 4 | 00:05:00 | 55.9 | 48.3 | 49.4 | 48 | 46.9 |
| 10:17:00 | 4 | 00:05:00 | 56.4 | 47.5 | 48.4 | 47.2 | 46 |
| 10:22:00 | 4 | 00:05:00 | 70.3 | 50.5 | 49.9 | 47.8 | 46.4 |
| 10:36:00 | 3 | 00:05:00 | 59.6 | 48.6 | 50.6 | 47.8 | 46.1 |
| 10:41:00 | 3 | 00:05:00 | 59.8 | 48.7 | 50 | 48 | 46.5 |
| 10:46:00 | 3 | 00:05:00 | 54.4 | 48.1 | 49.6 | 47.6 | 46.1 |
| 10:51:00 | 3 | 00:05:00 | 69.8 | 48.3 | 49 | 46.6 | 45.1 |
| 10:56:00 | 3 | 00:05:00 | 64.8 | 48.9 | 50.8 | 48 | 46.2 |
| 11:01:00 | 3 | 00:05:00 | 64.4 | 48.9 | 50.2 | 47.9 | 46.2 |
| 11:18:00 | 2 | 00:05:00 | 65.6 | 51.5 | 53.3 | 50.2 | 48.4 |
| 11:23:00 | 2 | 00:05:00 | 65.9 | 50.9 | 52.8 | 49.5 | 47.7 |
| 11:28:00 | 2 | 00:05:00 | 69.3 | 52.9 | 55.6 | 50.2 | 48.3 |
| 11:33:00 | 2 | 00:05:00 | 56.2 | 49.6 | 51.3 | 49.2 | 47.4 |

| Start | Position | Time | $L_{Amax}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A50}$ | $L_{A90}$ |
|---|---|---|---|---|---|---|---|
| 11:38:00 | 2 | 00:05:00 | 61.8 | 48.9 | 50.4 | 48.3 | 47 |
| 11:43:00 | 2 | 00:05:00 | 65.8 | 50.8 | 52.2 | 50 | 48.3 |
| Monday 20th February 2024 | | | | | | | |
| 23:05:00 | 1 | 00:05:00 | 89.7 | 70 | 73.1 | 58 | 42.8 |
| 23:10:00 | 1 | 00:05:00 | 84.8 | 68 | 72.4 | 58.2 | 43.3 |
| 23:15:00 | 1 | 00:05:00 | 82.4 | 69 | 73.8 | 59.5 | 48 |
| 23:20:00 | 1 | 00:05:00 | 85.1 | 68.2 | 72.7 | 56.2 | 46.9 |
| 23:25:00 | 1 | 00:05:00 | 93.5 | 76 | 73.2 | 57.5 | 44.8 |
| 23:30:00 | 1 | 00:05:00 | 85.3 | 68.1 | 72 | 58.7 | 44.6 |
| 23:40:00 | 2 | 00:05:00 | 60.5 | 43.2 | 45.3 | 41.8 | 39.5 |
| 23:45:00 | 2 | 00:05:00 | 45.9 | 41 | 42.4 | 40.6 | 39.7 |
| 23:50:00 | 2 | 00:05:00 | 52.6 | 42.5 | 44.9 | 41.2 | 39.4 |
| 23:55:00 | 2 | 00:05:00 | 58.2 | 41.4 | 43.7 | 40.2 | 38.3 |
| Tuesday 21st February 2024 | | | | | | | |
| 00:04:00 | 4 | 00:05:00 | 51.8 | 39.4 | 40.2 | 39 | 38.1 |
| 00:09:00 | 4 | 00:05:00 | 44 | 39.9 | 40.9 | 39.8 | 38.8 |
| 00:14:00 | 4 | 00:05:00 | 48.7 | 39.8 | 40.9 | 39.5 | 38.4 |
| 00:19:00 | 4 | 00:05:00 | 44.3 | 39.9 | 40.9 | 39.7 | 38.8 |
| 00:28:00 | 3 | 00:05:00 | 45.1 | 38.6 | 39.8 | 38.2 | 37.1 |
| 00:33:00 | 3 | 00:05:00 | 43.8 | 39.2 | 40.2 | 39 | 37.9 |
| 00:38:00 | 3 | 00:05:00 | 44.5 | 39.7 | 41.2 | 39.2 | 37.8 |
| 00:43:00 | 3 | 00:05:00 | 63.6 | 40.9 | 40.9 | 39 | 37.7 |

*Table B1 – Fully tabulated noise measurement results*